J & L

JUNIOR BEAM FLOORS

FOR

RESIDENCES

SCHOOLS

AND

OTHER LIGHT OCCUPANCY BUILDINGS

JONES & LAUGHLIN STEEL CORPORATION
AMERICAN IRON AND STEEL WORKS
PITTSBURGH.

J & L JUNIOR BEAMS FOR GENERAL CONSTRUCTION

THE J & L JUNIOR BEAM is the lightest rolled structural steel I-beam now available and was designed to provide the building industry with sections which would make possible new economies in practically all types of construction. That this object has been accomplished has been proved in hundreds of buildings ranging from small residences to large schools, stores, apartments, hospitals and many other light occupancy structures.

The Junior Beam is made of structural grade steel rolled from the billet to the full I-section in a continuous mill with but slight change in temperature from the reheating furnace to the cooling bed.

The function of the Junior Beam used as a floor beam or roof purlin is to carry the live and dead loads and transfer them to the heavier main carrying members of the frame work or to the supporting walls.

The data on the following pages are divided into two sections for convenience of use and because certain requirements govern the design and use of Junior Beams in general construction which do not apply when they are used in residences. The first section contains engineering design data and tables which the architect, engineer and contractor will use for buildings other than residences. Loads, spacings, end connections and floor and ceiling construction data affect the design in such buildings. The second section relates primarily to the layout and construction of floors for residences for which the design is less complicated and the plan usually involves fewer details and more simple construction.

Advantages of J & L Junior Beam Floors

The J & L Junior Beam Floor offers the architect and contractor many advantages. Some of these are suggested below and others will occur to the reader as he studies the data in this catalog.

Unusual economies due to the light weight of the floors and the consequent saving in main frame and foundations.

No shoring is necessary to place the concrete slabs. This reduces costs and permits workmen to install partitions, plumbing, and to do steam fitting, etc., without waiting for removal of the shoring.

Walls can be erected as soon as the steel is placed.

Junior Beams are carried in stock and are available without delay.

Jones and Laughlin Service

Jones & Laughlin District Sales Offices are situated in all important centers. J & L engineers familiar with J & L Junior Beams and their uses are available in these offices for advice and assistance.

When you desire to have detailed information in connection with the design of J & L Junior Beams, please ask the nearest office for Bulletin which contains all such data.

The JONES & LAUGHLIN STEEL CORPORATION offers, also, the aid of skilled field engineers to service any particular building operation in which Junior Beams are used.

JONES & LAUGHLIN STEEL CORPORATION
American Iron and Steel Works
PITTSBURGH, PENNSYLVANIA
For List of Sales Offices, Warehouses and Fabricating Plants—See Back Cover

ENGINEERING DATA ON J & L JUNIOR BEAMS FOR GENERAL CONSTRUCTION

Junior Beams are homogeneous steel I-sections in their original symmetrical form as rolled and, as such, can be used in structural design up to their full value by employing standard engineering formulae and without empirical assumptions.

Official Classification of Junior Beams

Junior Beams are extensively used throughout the United States and Canada in floor systems, the carrying capacity being based on the same fiber stress as that of standard weight structural steel sections.

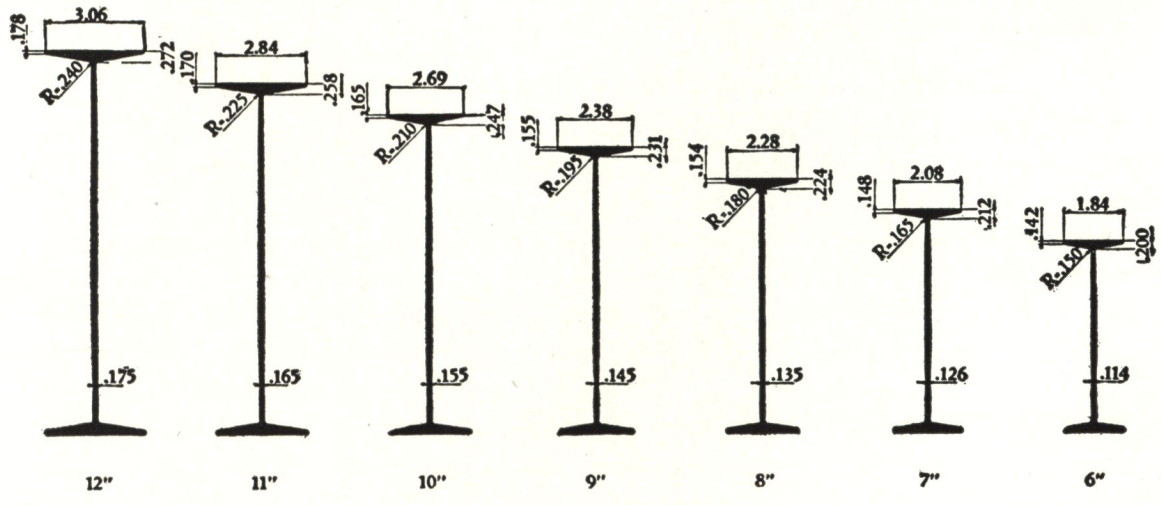
J & L Junior Beams are rated as structural steel by the American Institute of Steel Construction and their properties and dimensions are included in the handbook of information published by the Institute.

Uses for Junior Beams and General Construction

The principal use of Junior Beams is as secondary members in floor and roof construction of buildings. They are also being used in increasing quantities as purlins, rafters and girts for mill and hangar buildings, ceiling supports over auditoriums, protection sheds and scaffolding, monorails, supports for conveying and mechanical equipment, and all classes of structural work where, due to their light weight, they are the most economical sections to be used.

The adaptability of Junior Beams to floor construction provide many economies due to light weight of floor and ease of erection. A floor containing the least amount of steel, concrete and labor can be designed by judicious combination of companion materials. It is advantageous to utilize in good designs, the actual strength of properly proportioned thin concrete slabs by spacing Junior Beams to their capacity and also where practicable, designing the Junior Beams as continuous spans. The floor will be light, rigid, and have a minimum amount of deflection. It will be quickly erected, firesafe and soundproof. Precast gypsum slabs and other lightweight materials are also employed in obtaining similar economies.

Sizes, Weights and Properties of J & L Junior Beams



Depth, in.	Weight, lbs. per ft.	Flange width, in.	Web thickness, in.	Area, sq. in.	Radius of gyration		Moment of inertia		Section modulus	
					Hor. axis	Vert. axis	Hor. axis	Vert. axis	Hor. axis	Vert. axis
12	11.8	3.06	0.175	3.45	4.573	0.532	72.21	0.978	12.01	0.638
11	10.3	2.84	.165	3.01	4.200	.498	53.08	.746	9.63	.525
10	9.0	2.69	.155	2.64	3.847	.480	39.01	.608	7.78	.452
9	7.5	2.38	.145	2.20	3.450	.423	26.20	.394	5.81	.332
8	6.5	2.28	.135	1.92	3.116	.423	18.67	.343	4.65	.301
7	5.5	2.08	.126	1.61	2.744	.393	12.13	.248	3.45	.239
6	4.4	1.84	.114	1.30	2.372	.357	7.30	1.65	2.42	.179

TABLE OF SPACINGS

TOTAL SAFE LOADS FOR J & L JUNIOR BEAMS

FIBER STRESS—18,000 POUNDS PER SQUARE INCH

Span of Beam	Depth of Beam	Total Safe Uniform Load on Beam Pounds	TOTAL LOAD PER SQUARE FOOT and SPACING OF JUNIOR BEAMS IN INCHES															
			50 Lb.	60 Lb.	70 Lb.	80 Lb.	85 Lb.	90 Lb.	95 Lb.	100 Lb.	105 Lb.	110 Lb.	115 Lb.	120 Lb.	130 Lb.	140 Lb.	150 Lb.	160 Lb.
26′-0″	12″	5542	51	42½	36½	32	30	28½	27	25½	24½	23	22	21	19½	18	17	16
25′-0″	12″	5764	55	46	39½	34½	32½	30½	29	27½	26½	25	24	23	21	19½	18½	17
24′-0″	12″	6004	60	50	43	37½	35½	33½	31½	30	28½	27	26	25	23	21½	20	18½
	11″	4815	48	40	34	30	28	26½	25	24	23	22	21	20	18½	17	16	15
23′-0″	12″	6265	65	54½	46½	41	38½	36½	34	32½	31	29½	28½	27	25	23	21½	20½
	11″	5024	52	43½	37½	32½	31	29	27½	26	25	23½	22½	21½	20	18½	17½	16
22′-0″	12″	6549	71	59½	51	44½	42	39½	37½	35½	34	32½	31	29½	27½	25½	23½	22½
	11″	5253	57	47½	41	36	33½	31½	30	28½	27	26	25	24	22	20½	19	18
	10″	4244	46	38½	33	29	27	25½	24½	23	22	21	20	19	18	16½	15½	14½
21′-0″	12″	6861	78½	65½	56	49	46	43½	41½	39	37½	35½	34	32½	30	28½	26	24½
	11″	5503	63	52½	45	39½	37	35	33	31½	30	28½	27	26	24	22½	21	19½
	10″	4446	51	42½	36½	32	30	28	26½	25½	24	23	22	21	19½	18	17	16
20′-0″	12″	7204	86½	72	61½	54	51	48	45½	43	41½	39	37½	36	33	31	29	27
	11″	5778	69½	57½	49½	43	41	38½	36½	34½	33	31½	30	29	26½	25	23	21½
	10″	4668	56	46½	40	35	33	31	29½	28	26½	25½	24	23	21½	20	18½	17½
	9″	3486	42	35	30	26	24½	23	22	21	20	19	18	17½	16	15	14	13
19′-0″	12″	7584	96	80	68½	60	56½	53½	50½	48	45½	43½	41½	40	37	34½	32	30
	11″	6082	77	64	55	48	45	42½	40½	38½	36½	35	33½	32	29½	27½	25½	24
	10″	4914	62	51½	44½	38½	36	34½	32½	31	29½	28	27	26	24	22	20½	19½
	9″	3670	46½	38½	33	29	27	25½	24½	23	22	21	20	19½	18	16½	15½	14½
18′-0″	12″	8005	107	89	76	67	63	59½	56½	53½	51	48½	46½	44½	41	38	35½	33½
	11″	6420	85½	71½	61	53½	50½	47½	45	43	41½	39	37	35½	33	30½	28½	26½
	10″	5187	69	57½	49½	43	40½	38½	36½	34½	33	31½	30	29	26½	24½	23	21½
	9″	3874	51½	42	37	31½	29½	28	26½	25	24	23	22	21½	19½	18	17	16
	8″	3101	41½	34½	29½	26	24½	23	22	20½	19½	18½	18	17	16	14½	14	13
17′-0″	12″	8476	120	100	85½	75	70½	66½	63	60	57	54½	52	50	46	42½	40	37½
	11″	6797	96	80	68½	60	56½	53½	50½	48	45½	43½	41½	40	37	34½	32	30
	10″	5492	77½	64½	55½	48½	45½	43	41	39	37	35	33½	32	30	27½	26	24
	9″	4102	58	48	41½	36	34	32	30½	29	27½	26½	25	24	22	20½	19½	18
	8″	3283	46½	38½	33	29	27	25½	24½	23	22	21	20	19½	18	16½	15½	14½
16′-0″	11″	7222	108	90	77½	67½	64	60½	57	54	51½	49	47	45	41½	39	36	34
	10″	5836	87½	73	62½	54½	51½	48½	46	44	41½	40	38	36½	33½	31	29	27
	9″	4358	65	54½	46½	40½	38	36	34	32½	31	29½	28½	27	25	23	21½	20½
	8″	3489	52½	43½	37	33	31	29	27½	26	25	24	22½	21½	20	18½	17½	16½
	7″	2589	39	32	27½	24	23	21½	20½	19½	18½	17½	17	16	15	14	13	12
15′-0″	11″	7704	123	102½	88	77	72½	68½	65	61½	58½	56	53½	51½	47½	44	41	38½
	10″	6225	100	83	71	62½	58½	55½	52½	50	47½	45	43½	41½	38½	35½	33	31
	9″	4648	74½	62	53	46½	44	41½	39	37	35½	34	32	31	28½	26½	24½	23
	8″	3721	59½	49½	42½	37	35	33	31½	30	28½	27	26	25	23	21	20	18½
	7″	2762	44	37	31½	27½	26	24½	23	22	21	20	19	18½	17	15½	14½	13½
14′-0″	10″	6669	114	95	81½	71½	67	63½	60	57	54½	52	49½	47½	44	41	38	35½
	9″	4981	85½	71	61	53½	50	47½	45	42½	41½	39	37	35½	33	30½	28½	26½
	8″	3987	68½	57	49	42½	40	38	36	34	32½	31	29½	28½	26	24½	22½	21½
	7″	2959	51	42	36½	32	30	28	26½	25½	24	23	22	21	19½	18	17	16
	6″	2077	35½	29½	25½	22	21	20	18½	18	17	16	15½	14½	13½	12½	12	11
13′-0″	10″	7182	132	110	95	83	78	74	70	66	63½	60	57½	55	51	47½	44	41½
	9″	5364	99	82½	71	62	58½	55	52	49½	47	45	43	41	38	35	33	31
	8″	4294	79½	66	56½	49½	46½	44	41½	39½	38	36	34½	33	30½	28	26½	24½
	7″	3187	59	49	42	37	34½	32½	31	29½	28	26½	25½	24½	22½	21	19½	18½
	6″	2236	41½	34½	29½	25	24	23	21½	20½	19½	18½	18	17	16	14½	13½	13
12′-0″	9″	5811	116	96½	83	72½	68	64½	61½	58	55½	53	50½	48½	44½	41½	38½	36
	8″	4651	93	77½	66½	58	55	51½	49	46½	44½	42	40½	39	36	33	31	29
	7″	3452	69	57½	49	43	40½	38½	36	34½	33	31½	30	28½	26½	24½	23	21½
	6″	2423	48½	40½	34½	30	28½	27	25½	24	23	22	21	20	18½	17	16	15
11′-0″	9″	6339	138	115	99	86½	81½	77	73	69	66	63	60	57½	53	49½	46	43
	8″	5074	111	92	79	69	65½	61½	58½	55½	52½	50	48	46	42½	39½	37	34½
	7″	3766	82	68½	59	51	49	45½	43½	41	39	37	35½	32½	31½	29½	27	25½
	6″	2643	57½	48	41	36	34	32	30½	29	27½	26	25	24	22	20½	19	18
10′-0″	8″	5582	134	111	96	84	79	74½	70½	67	64	61	58	56	51½	48	45	42
	7″	4143	99	82½	71	62	58	55	52	49½	47	45	43	41½	38	35½	33	31
	6″	2907	69½	58	50	43½	41	39	36½	35	33	31½	30½	29	27	25	23	21½
9′-0″	7″	4603	123	102	87½	76½	72	68	64½	61½	58½	56	53	51	47	44	41	38
	6″	3230	86	71½	61½	53½	50½	48	45	43	41	39	37½	36	33	31	29	27
8′-0″	7″	5178	155½	129½	111	97	92	86½	82	77½	74½	70½	67	64½	59½	55½	51½	48½
	6″	3634	109	91	78	68	64	60½	57½	54½	52	49½	47½	45½	42	39	36	34

* In designing Junior Beam Floors, bear in mind that the use of the deepest Junior beam at the widest spacing will provide a floor having the least amount of steel per square foot.

END CONNECTIONS FOR J & L JUNIOR BEAMS

The illustrations below show the method of framing Junior Beams to a steel frame with clip angles, and details of the standard Junior Beam end connection.

Clip Angle End

Figs. 1 and 2 show how Junior Beams are framed to the main carrying members by use of one clip angle at each end of the Junior Beam. The Junior Beams and carrying beams are merely punched before shipment. The clip angles may be shipped loose, or bolted to either the Junior Beams or to the primary members, as desired.

Standard End

Figs. 3, 4 and 5 show details of the J & L standard Junior Beam end. The end is composed of two angles riveted back to back on the Junior Beam. In all three of these sketches, the top of the Junior Beams are $2\frac{1}{2}''$ above the supporting structural members.

Fig. 3 shows the standard end for 6″, 7″ and 8″ Junior Beams.

Fig. 4 shows the standard end for 9″ and 10″ Junior Beams.

Fig. 5 shows the standard end for 11″ and 12″ Junior Beams.

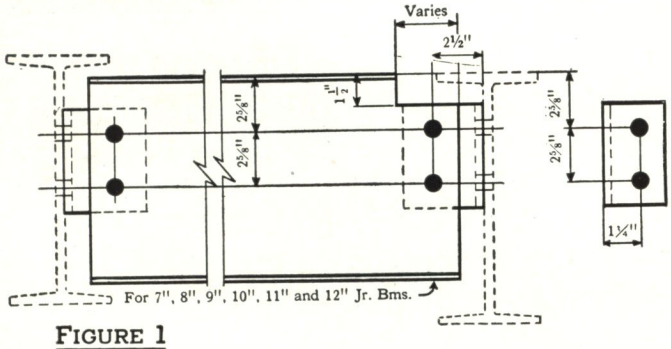


FIGURE 1

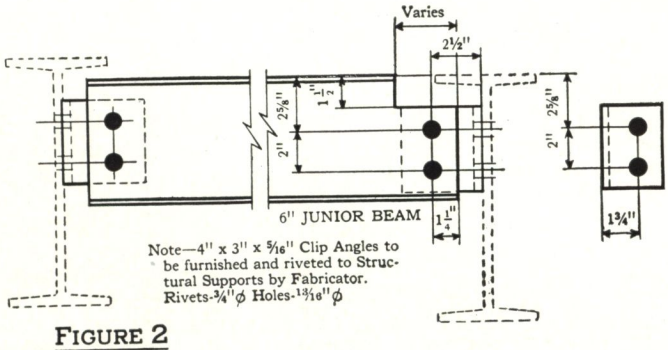


FIGURE 2

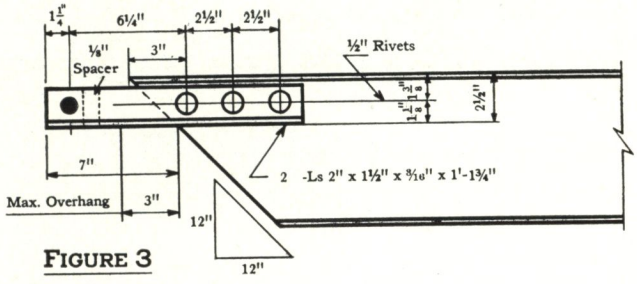


FIGURE 3

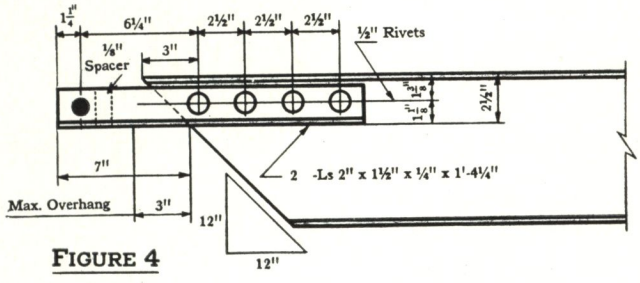


FIGURE 4

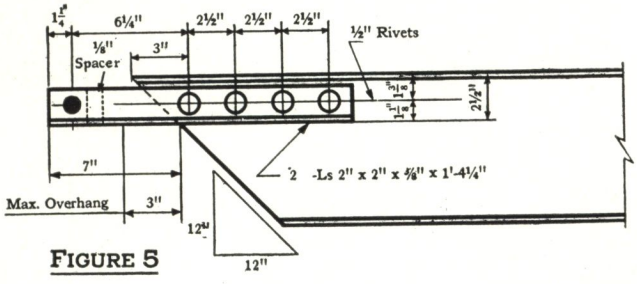
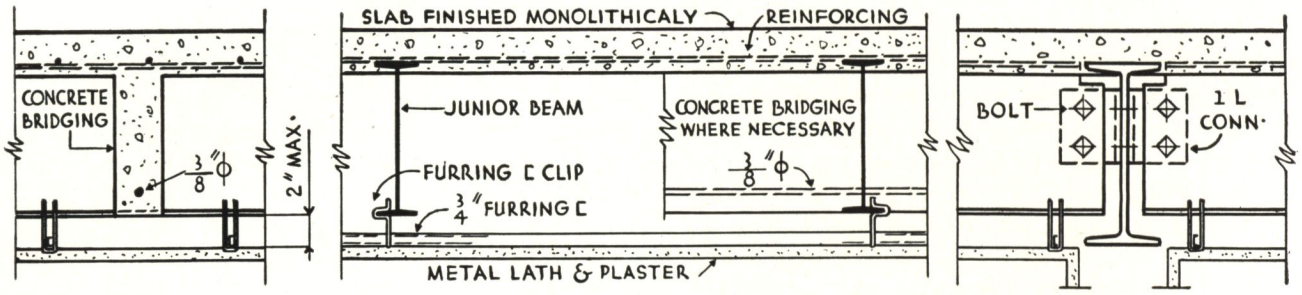


FIGURE 5

J & L JUNIOR BEAMS FLOORS IN GENERAL CONSTRUCTION

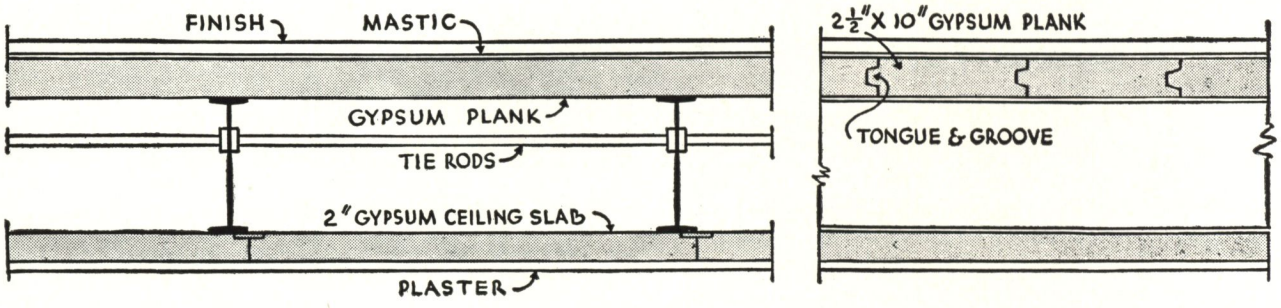
Monolithically-Finished Concrete Floor



Where possible the Junior Beams are made continuous over three supports or more.

By encasing the top flanges, the floor is made rigid and does not require bridging in light occupancy buildings. Where concentrated loads must be transferred over two or more beams, it is done by the use of concrete bridging poured monolithically with the slab. The slab is poured on a simple form, of either wood or metal. If wood is used, the beams can be spaced so that ripping of form boards is avoided. Clips are furnished for fastening the ceiling furring channels to the bottom flanges, allowing 2 inches of space to the bottom of the channels in which to run electrical conduits. This is the most economical quality floor that can be built.

Gypsum Slabs

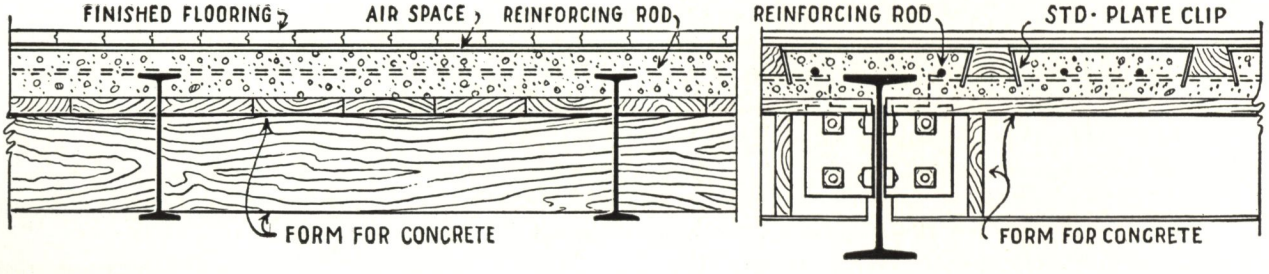


The lightest type of floor providing four-hour fire protection is obtained by the use of precast gypsum floor planks and ceiling slabs, securely fastened to the Junior Beams by means of clips and hangers.

The floor planks are furnished in lengths 6 ft. 0 in. to 10 ft. 0 in. and the Junior Beams spaced to accommodate the required loading.

This floor is quickly erected and due to the light weight, effects considerable economy in the main steel frame and foundations.

Wood Form — Concrete Slab — Wood Floor



This type of Junior Beam floor is easy to install and is especially satisfactory. When 8 in. Junior Beams are used, the spreaders (vertical boards supporting form) will be 1 in. by 6 in. The form is constructed of ordinary sheathing. The reinforcing is ¼ in. rods, 6 in. to 8 in. o. c., and the wooden sleepers, fastened to the top flanges of the Junior Beams with standard plate clips, are spaced 12 in. to 16 in. o. c. No bridging is necessary as the concrete slab engages and holds rigidly the top flanges of the steel. Plaster ceiling is applied in the same manner shown at top of page in details of monolithically-finished concrete floor.

SPECIFICATIONS FOR J & L JUNIOR BEAMS IN GENERAL CONSTRUCTION

Architects and engineers should include Junior Beams in the structural steel section of specifications, as they are an integral part of the structural framework of the building, to be supplied by the structural steel contractor. This procedure insures proper co-ordination of design and detail under one engineering control and also proper timing of arrival of all structural material to the site and erection by the same erector.

The following specifications have been developed with the idea that they will aid designers in properly specifying J & L Junior Beams. Specifications may be used either in whole or in part with absolute confidence; they represent the best thought and standard practice at the present time.

Description—The structural part of the floor system shall consist of the slab supported on Jones & Laughlin Junior Beams, acting as secondary members of dimensions as shown on drawings. Before shipment, all J & L Junior Beams shall be given a coat of paint.

Partitions—Proper provision shall be made in the loading for the weight of partitions.

Bridging—The J & L Junior Beam shall be bridged as shown on the drawings with (tension compression) (tie rod) (solid concrete crossbeam) (12½ gauge wire). Where wire or tie rod bridging is used, the end Junior Beam in each panel shall be fastened to bridging anchors set in outside wall or to parallel structural steel.

Wall Plates—Standard Junior Beam wall plates shall be used under the ends of Junior Beams resting on bearing walls.

Anchors—Where Junior Beams rest on masonry walls, a ½ in. by 8 in. round anchor shall be used (in such Junior Beams as the local building code requires).

Sleepers—Where wood floors on top of concrete slabs attached to sleepers are specified, the sleepers shall be preferably of hardwood, embedded in the slab. Sleepers shall be attached to the tops of Junior Beams by means of proper clips. Sleepers shall be run (at right angles to the Junior Beams and be spaced . . . in. apart) (diagonally to the Junior Beams). Substitution may be made for the above, dependent upon the type of floor system under consideration.

Floor Slabs—Concrete floor slabs shall be designed to suit the loading and spacing of Junior Beams. The slabs shall be poured on (self-centering lath) (paper-backed fabric) (removable forms). The concrete shall be composed of one part cement and a graded mixture consisting of not more than seven parts of fine and coarse aggregate. Where the slab is poured on lath, it shall be mixed sufficiently dry to prevent dripping. Where the slab is poured on removable forms, the maximum size of the aggregate shall be ½ in. and the concrete shall be of a consistency which will allow it to encase the beam flanges and flow under the wood sleepers. Where floor slabs of other material than concrete are used, they shall be designed to carry the specified loading in accordance with manufacturer's specifications.

Permanent Centering—Lath shall be applied with sheets running at right angles to the Junior Beams. Metal lath shall be securely fastened to the tops of the Junior Beams with lath clips on 12 in. centers, except at ends of sheets where lath clips shall be at 6 in. centers, and applied with a special tool furnished by the manufacturers of the J & L Junior Beams. Lath sheets shall be securely wired together along the side laps midway between Junior Beams. Any approved form of metal lath or backed floor fabric may be used. Any and all clips, ties, or other accessories necessary for the proper application of each particular type of centering shall be used in accordance with these specifications or the specifications of the manufacturer of the respective centering materials. The writer of the specifications shall define the type and quality of the centering to meet the particular requirements.

Removable Forms—Either wood or steel forms may be employed, placed so that the compression flange of the Junior Beams will be embedded. Where a plaster ceiling is not used and appearance is a factor, there should be a minimum of ¾ in. embedment of top flange. Standard practice regarding the use of shoreless forms will obtain.

Temperature and Shrinkage Reinforcing—When finished floors are made of composition, terrazzo or materials other than wood, provisions shall be made for proper size of steel reinforcing.

Ceiling Lath—Ceiling lath, covered elsewhere under plastering specifications shall be firmly wired to (pencil rods) (furring channels) which in turn shall be securely fastened to the bottom flanges of the Junior Beams by means of approved clips. Use of J & L furring clip to obtain proper space for conduits is recommended.

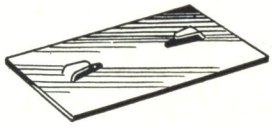
Where the spacings of the Junior Beams are narrow, flat or ribbed lath may be fastened directly, by means of an approved clip, to the lower flanges of the Junior Beams. Ribbed lath shall be applied so that the ribs are at right angles to the direction of the pencil rods, or, when pencil rods are omitted, to Junior Beams.

HANGERS AND ACCESSORIES FOR J & L JUNIOR BEAMS

BEAM ANCHOR

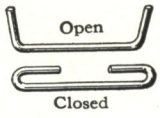
For use in anchoring Junior Beams in masonry wall. This anchor is supplied in one size only, as shown. Requires a 13/16 in. hole punched in center of web of Junior Beam, 2 in. from end.

WALLBEARING PLATE



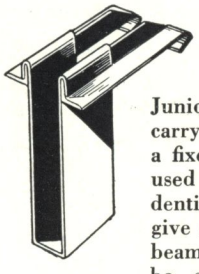
Holds Junior Beam steadily in vertical position during erection. Made in seven sizes, one for each Junior Beam. When ordering, specify depth of Junior Beams.

LATH CLIP

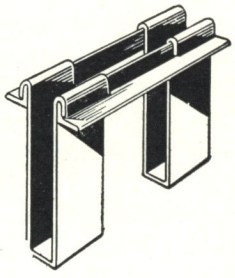


For attaching metal lath to either top or bottom flanges of Junior Beams. Made in seven sizes, one for each Junior Beam. When ordering, specify depth of Junior Beams.

STANDARD STIRRUP HANGERS



Single

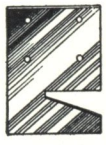


Double

Single: For supporting one Junior Beam at right angles to another Junior Beam or structural carrying beam. This is not a fixed connection and is used principally in residential floors. In ordering, give size of both carrying beam and Junior Beam to be supported. For use where top flanges of beams are to be flush.

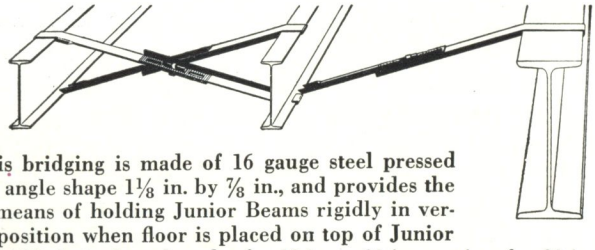
Double: For use as above where Junior Beams are opposite each other and supported by one primary member.

STANDARD PLATE CLIP FOR SLEEPERS



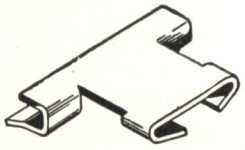
This plate clip is used for fastening sleepers to top flanges of Junior Beams. It is also used for fastening ceiling screeds to bottom flanges of Junior Beams.

RIGID BRIDGING



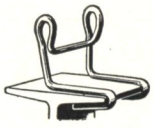
This bridging is made of 16 gauge steel pressed to an angle shape 1⅛ in. by ⅞ in., and provides the best means of holding Junior Beams rigidly in vertical position when floor is placed on top of Junior Beams. Made in three lengths, for 12 in. to 20 in. spacing, for 20 in. to 30 in. spacing and for 30 in. to 36 in. spacing. In ordering, give number of pairs required and spacing of Junior Beams. Wire Bridging can be used as an alternate in certain localities.

TOP FLANGE CLAMP



To be attached to top flanges of Junior Beams when Junior Beams rest on shelf angles. A similar clamp is furnished for attachment to the bottom flange of Junior Beams when Junior Beams rest on top of structural members. The latter clamp has an offset equal to the thickness of the flange of the structural member. These clamps hold Junior Beam steadily in vertical position during erection.

SCREED CHAIRS



Type R

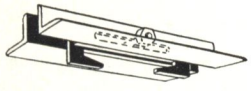
Type P

To be used in association with metal lath and concrete construction.

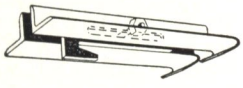
Type R—To be used when the sleeper is placed at right angles to the Junior Beams. Sleepers are held securely by nails through loops in sides of chair.

Type P—For use as above when sleepers run parallel with Junior Beams.

STANDARD ADJUSTABLE ANGLE HANGERS



Double



Single

Double: This connection used principally in residential floors, may be used to support Junior Beams at right angles to and on top of main carrying member. Junior Beams project 2½ in. above top flange of main carrying member. Ends of Junior Beams must be cut at an angle of 45 degrees.

Single: To be used under same conditions as double hangers, but to support Junior Beam on only one side of main carrying member.

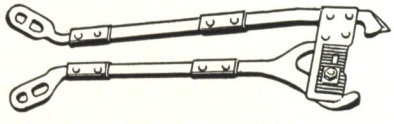
REINFORCING ROD CLIP

For attaching ¼ in. reinforcing rods to either top or bottom flanges of Junior Beams.

FURRING CHANNEL CLIP

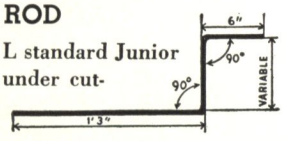
For attaching furring channels to bottom flanges of Junior Beams to provide for plastered ceiling. This clip is supplied in four sizes: ¾ in., 1 in., 1½ in. and 2 in. In ordering, specify size required.

LATH CLIP TOOL



Used for crimping standard lath clips on flanges of Junior Beams.

CEILING EXTENSION ROD



To be used in connection with J & L standard Junior Beam end. This rod carries ceiling under cut-out end of Junior Beam.

BRIDGING ANCHOR

To be used at end of a run of wire bridging. Anchor in wall and attach to both top and bottom flanges of Junior Beam.

J & L JUNIOR BEAM FLOORS FOR RESIDENCES

Study of deterioration in residential construction reveals that, even with the best of foundations, walls and roof, serious and expensive defects develop as soon as shrinkage occurs in the floor joists, as it will when they are of wood. The immediate effect of this shrinkage is a settling of all interior construction depending on the floor joists for support. The results are plaster cracks in walls and ceilings, twisted door frames, uneven floors and gaps between baseboards and flooring.

When the J & L Junior Beam floor for residences is used, the first floor is an integral part of the foundations, providing the same rigid, vibration-free, non-shrinkable support for the interior walls of the house that the foundations provide for the exterior walls. It acts as a complete fire stop between the basement and the remainder of the house, and prevents moisture from rising through partition walls to the floors above. It is vermin-proof and impervious to the attacks of termites.

The J & L Junior Beam floor for residences is universally adaptable. It may be used as the first floor of any house, without imposing any restrictions whatever on either the architect or the builder. The additional advantages of having the same steel and concrete system for the floors above the first are available in any house having solid masonry walls or steel framing. Any type of wearing surface may be applied, hardwood, terrazzo, tile, linoleum, composition block, etc. By following the methods described and illustrated in the following pages, the architect can easily design a Junior Beam floor and any experienced builder can make up his list of materials and install this steel and concrete system as easily as the old-fashioned wooden joist floor. The materials may be obtained through the usual sources of steel supply, or the Jones & Laughlin Steel Corporation will furnish the names of Junior Beam dealers in any given territory.

CONSTRUCTION OF A J & L JUNIOR BEAM FLOOR

The principal materials in the J & L Junior Beam floor for residences are steel and concrete, combined to give maximum structural soundness at lowest cost. No fabrication is required for connecting the steel beams. See Figure 1, in which (1) shows how Junior Beams rest on lower flange of carrying member and (2) how standard stirrup hanger is used to support Junior Beam at right angle to another Junior Beam or standard I-beam.

Fig. 2-a illustrates the installation of the Junior Beam Floor in veneer construction. Outside brick wall, interior wall, concrete firestop and slab and the hardwood wearing surface are cut away to show details of the floor. The Junior Beams are shown resting directly on concrete foundations. The sleepers (2 in. by 3 in. wooden nailing strips) are held securely to the steel by two plate clips at each point where they cross a Junior Beam. Two plain steel reinforcing bars, ¼ in. in diameter, are fastened to the Junior Beams between sleepers. The concrete floor slab and the concrete firestop along the foundation wall are then poured in temporary wooden forms, imbedding the top flanges of the Junior Beams, so that the beams, sleepers and reinforcing rods are held rigidly in place. Sleepers are spaced from 12 in. to 16 in. apart and the concrete is leveled approximately ¼ in. to ⅜ in. below the tops of them. The hardwood floor is nailed directly to the sleepers. The 2 in. by 4 in. plate for receiving sidewall studs is nailed to wooden blocks imbedded in the concrete firestop along the sidewall shown.

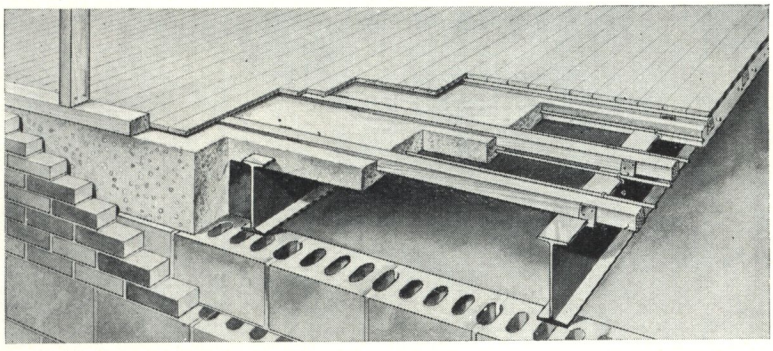


Figure 2-a

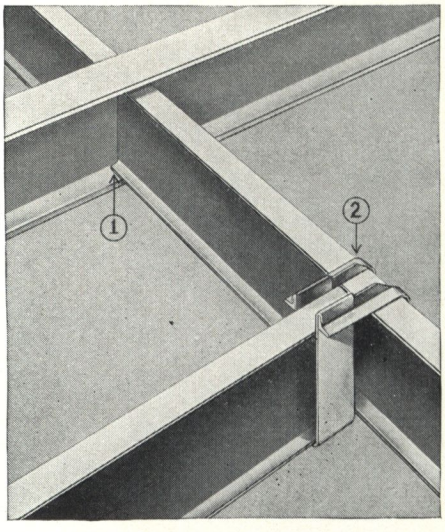


Figure 1

Fig. 2-b shows the J & L Junior Beam floor for residences with linoleum finish. When the finished floor is to be linoleum, tile, terrazzo, wood parquet or any material to be set in mastic, no sleepers are necessary. The concrete slab is floated smooth at the time of pouring, and requires no separate finish to receive the mastic. The finished flooring is then applied according to the manufacturer's specifications. In this floor, ¼ in. steel reinforcing bars are placed 18 in. apart at right angles to the principal reinforcing of similar material, to prevent temperature cracks in the slab. Reinforcing mesh of equivalent strength may be used in place of reinforcing bars.

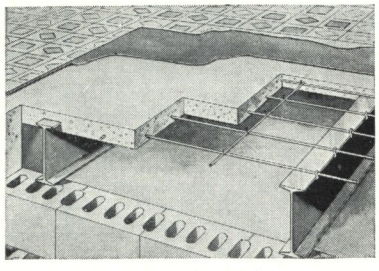


Figure 2-b

HOW TO LAY OUT A J & L JUNIOR BEAM FIRST FLOOR FOR A TYPICAL RESIDENCE

In the laying out of a house for Junior Beam Floors, approximately the same system that is used in placing wood supports can be applied to locating the steel beams and supporting columns. The main carrying beam is placed under the bearing partition. The Junior Beams are then located in the same manner as wooden joists. Junior Beams are doubled under non-bearing partitions. In framing a stairwell, a Junior Beam, supported by the standard stirrup hanger, serves as the header.

Fig. 3 shows the first floor architectural plan and the corresponding steel layout for a representative moderate priced house. The bearing partition separating the living room from the dining room and kitchen, supports the floor joists of the second floor and attic. Therefore, the main carrying member is located under this partition. In this house, the position of the stairwell prevents running the main carrying member from wall to wall, so it is stopped at the stairwell and supported by a basement column, either a pipe or H-column with plates welded or bolted on both top and bottom. Another main carrying member is placed across the projection at the front of the house.

The next step in laying out the steel is the locating of the Junior Beams that frame the stairwell. The flanges of these beams should be kept approximately 1 in. from the stair opening to allow for plastering. Next, two Junior Beams are located under each of the non-bearing partitions (the one partition separating dining room and kitchen and the other separating living room and stairway to second floor). The final step is the locating of the remaining Junior Beams necessary to carry the floor only, at spacings that are multiples of the width of the boards to be used for the concrete form. For detail drawings of floor construction see pages 13 and 14.

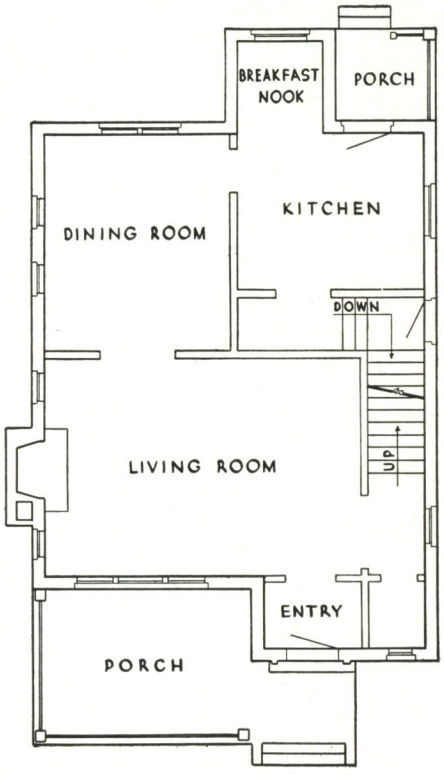
The Junior Beam layout is based on the beam sizes and spacings shown in the table on page 11. The range of live loads in this table covers requirements of all the various building codes. In addition to these live loads, a dead load of 45 lbs. per square foot is provided for in the spacings given. The dead load is made up of:

Finished Flooring	4 lbs. per sq. ft.
Concrete	30 lbs. per sq. ft.
Junior Beams	3 lbs. per sq. ft.
Plaster ceiling	8 lbs. per sq. ft.
Total dead load	45 lbs. per sq. ft.

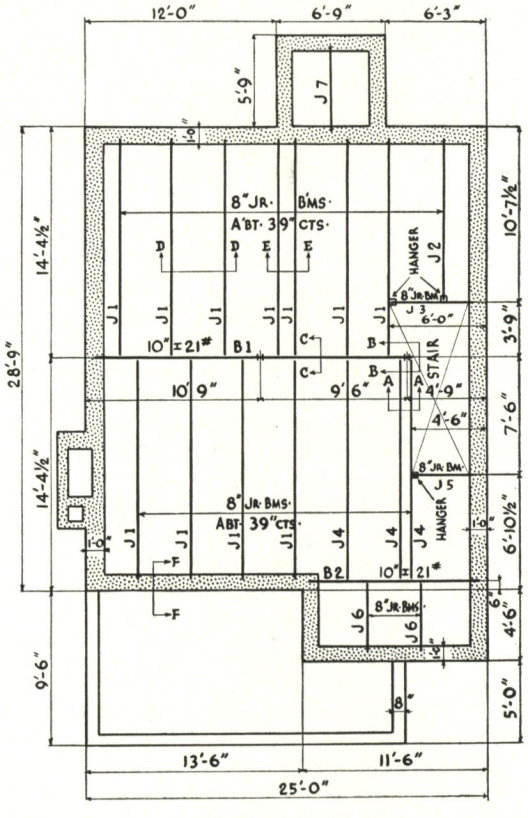
The spacings given in the table are based on the use of 8 in. common lumber (four, five or six boards between Junior Beams).

Use of Junior Beams of the same size throughout the floor represents the simplest construction. This eliminates need for end fabrication of the steel and for bringing foundation walls to different levels. Generally the saving in money on these two items will more than cover the extra cost of any excessive weight in the steel used. By referring again to the table it will be noted that the 8 in. Junior Beam can be used for spans up to 16 feet, and will meet the floor plan requirements of most moderately priced houses.

Occasionally a condition is encountered that obviously will overload a Junior Beam. Where this occurs the Junior Beam should be replaced by a standard I-beam of equal depth. Overloading of Junior Beams is most likely to result from use of tile floor and tile walls in bathrooms and from exceptionally wide stair openings.



First Floor Plan



First Floor Steel Plan

Figure 3

(For Construction Details at Section Points on First Floor Steel Plan refer to Pages 13 & 14)

TABLE OF JUNIOR BEAM SPACINGS
For Various Live Loads

Span	20 Lb. L. L.		30 Lb. L. L.		40 Lb. L. L.		50 Lb. L. L.		60 Lb. L. L.	
	Size ins.	Space ins.	Size ins.	Space ins.	Size ins.	Space ins.	Size ins.	Space ins.	Size ins.	Space ins.
12′-0″	6	31	6	31	—	—	—	—	—	—
	7	46	7	46	7	39	7	31	7	31
	8	46	8	46	8	46	8	46	8	39
	9	46	9	46	9	46	9	46	9	46
13′-0″	6	31	—	—	—	—	—	—	—	—
	7	39	7	39	7	31	7	31	8	31
	8	46	8	46	8	46	8	39	9	46
	9	46	9	46	9	46	9	46	10	46
14′-0″	7	39	7	31	8	39	8	31	8	31
	8	46	8	46	9	46	9	39	9	39
	9	46	9	46	10	46	10	46	10	46
15′-0″	7	31	8	39	8	31	8	31	9	31
	8	46	9	46	9	39	9	39	10	46
	9	46	10	46	10	46	10	46	11	46
16′-0″	8	39	8	31	8	31	9	31	9	31
	9	46	9	39	9	39	10	46	10	39
	10	46	10	46	10	46	11	46	11	46
17′-0″	8	31	8	31	9	31	9	31	10	31
	9	39	9	39	10	46	10	39	11	46
	10	46	10	46	11	46	11	46	12	46
18′-0″	8	31	9	31	9	31	10	31	10	31
	9	39	10	46	10	39	11	46	11	39
	10	46	11	46	11	46	12	46	12	46
19′-0″	9	31	9	31	10	31	10	31	11	31
	10	46	10	39	11	46	11	39	12	46
	11	46	11	46	12	46	12	46	—	—
20′-0″	9	31	10	31	10	31	11	31	11	31
	10	39	11	46	11	39	12	46	12	39
	11	46	12	46	12	46	—	—	—	—
21′-0″	10	39	10	31	11	31	11	31	12	31
	11	46	11	39	12	46	12	39	—	—
	12	46	12	46	—	—	—	—	—	—
22′-0″	11	39	11	39	11	31	11	31	12	31
	12	46	12	46	12	39	12	39	—	—
23′-0″	11	39	11	31	11	31	12	31	12	31
	12	46	12	39	12	39	—	—	—	—
24′-0″	12	39	12	39	12	31	12	31	12	29

NOTE:—When spacings are greater than 39″, sleepers should be 2″ x 4″ laid flat, instead of the usual 2″ x 3″ beveled sleepers.

TYPICAL BILL OF MATERIALS

The bill of materials for the first floor of this typical house, made up from only the completely dimensioned foundation plan (Figure 3), is as follows:

1 piece 10″ I 21 lb. x 20′-1″ marked B1 (flat flange)
1 piece 10″ I 21 lb. x 10′-6″ marked B2 (flat flange)
11 pieces 8″ Jr. Bms. x 13′-7¼″ marked J1
1 piece 8″ Jr. Bm. x 9′-8½″ marked J 2
1 piece 8″ Jr. Bm. x 5′-1″ marked J3
3 pieces 8″ Jr. Bms. x 13′-9″ marked J4
1 piece 8″ Jr. Bm. x 3′-7″ marked J5
2 pieces 8″ Jr. Bms. x 4′-2¾″ marked J6
1 piece 8″ Jr. Bm. x 5′-4″ marked J7

2 pieces 4″ H 13.8 lb. Cols. x 6′-8″ with 8″ x ½″ x 8″ Base Plate and 6″ x ½″ x 6″ Cap Plate.

3 Standard stirrup hangers for 8″ Jr. Bms. supported by 8″ Jr. Bms.

1300 Lineal feet of ¼″ Round Reinforcing Bars.

450 Standard Plate Clips for Sleepers.

200 Reinforcing Bar Clips.

B1 and B2 to be punched with 13/16″ holes staggered in top flange about 3′-0″ apart.

1 Beam J1 and J4, and Beams J3 and J5 to be punched in web with 13/16″ holes 2′-6″ Cts. for attaching blocks around stairwell.

If flexible conduit is used all beams should be punched with 13/16″ holes in webs about 4′-0″ Cts.

The length given for the main carrying beam allows 6″ bearing on the foundation wall and holds the other end, supported by columns, 1″ from the stair opening. Junior Beams are specified at lengths that allow 3½″ bearing on foundation walls and approximately ¾″ clearance from center of main carrying member to allow for the web thickness of that section.

The Junior Beam stairwell headers (J3 and J5 on Figure 3) are cut to allow approximately ¼″ clearance between the ends of them and the edge of the flanges of the Junior Beams (J1 and J4 on Figure 3) on which they are supported by standard stirrup hangers. Note that in ordering standard stirrup hangers to support one beam at right angles to another, the size and type of both the beam to be supported and the carrying beam must be specified.

APPLYING THE J & L JUNIOR BEAM SYSTEM TO FLOORS ABOVE THE FIRST

In the preceding page the application of the Junior Beam system has been limited to the first floor, as a Junior Beam first floor may be installed in any house regardless of the materials used for frame and outside wall. The additional advantages of also having the Junior Beam system in floors above the first are available in any house having masonry walls or steel framing.

While Junior Beam floors throughout a house represent additional dead load, the footer course under foundation walls need not be wider than the usual 18 in. or 24 in., providing the soil will safely support a load of 3,000 lbs. per sq. ft. The load on exterior walls is about 4,500 lbs. per lin. ft. The load on the columns is 90 lbs. per sq. ft. of floor supported when the live load is calculated at 40 lbs. In this house, the center column supports 420 sq. ft. of floor, or about 36,000 lbs. and the column footing should be designed accordingly.

The vertical supports may be either regular pipe columns or 4 in. H-sections with plates welded or bolted on both top and bottom. Plates on the columns should not be wider than flange on the main carrying member the columns support. The only holes in all of this steel construction which must be located accurately are those in the flanges of the main carrying members providing for bolting these beams to the plates on the ends of the columns. As in Junior Beam first floor construction, Junior Beams throughout other floors are rested on masonry walls and bottom flanges of main carrying members, or are supported in standard hangers.

THE J & L JUNIOR BEAM SECOND FLOOR

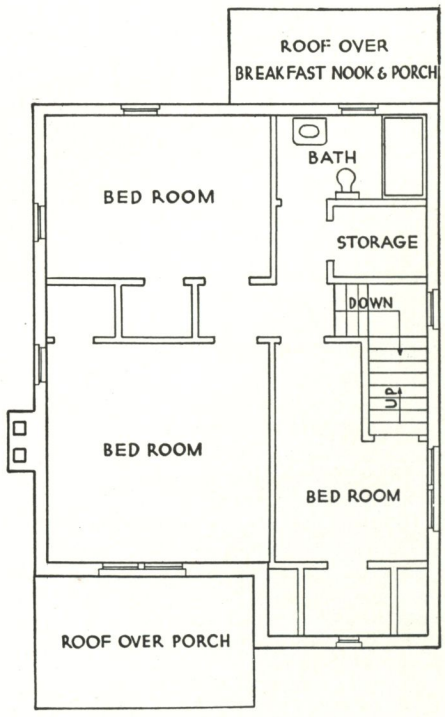
The second floor architectural and steel plans (Fig. 4, next page) illustrate how the same beam arrangement used in the first floor is retained as far as possible in the second floor, with the main carrying member and supporting columns in the same relative positions. This allows for duplication in lengths of materials used in the two floors and also permits the builder to use much of his form lumber in the second floor just as he used it in the first floor.

The procedure in laying out the steel for the second floor is the same as that followed in making up the bill of materials for the first floor. The main carrying member is located, the stairwell framed, Junior Beams doubled under non-bearing partitions and the remaining area spanned by Junior Beams spaced to correspond as nearly as possible with the first floor Junior Beam spacing. It will be noted that a header beam has been placed across the projection at the rear of the house, to support the wall above it, just as a similar header beam was placed across the projection at the front of the house in the first floor steel plan. Because of the addi-

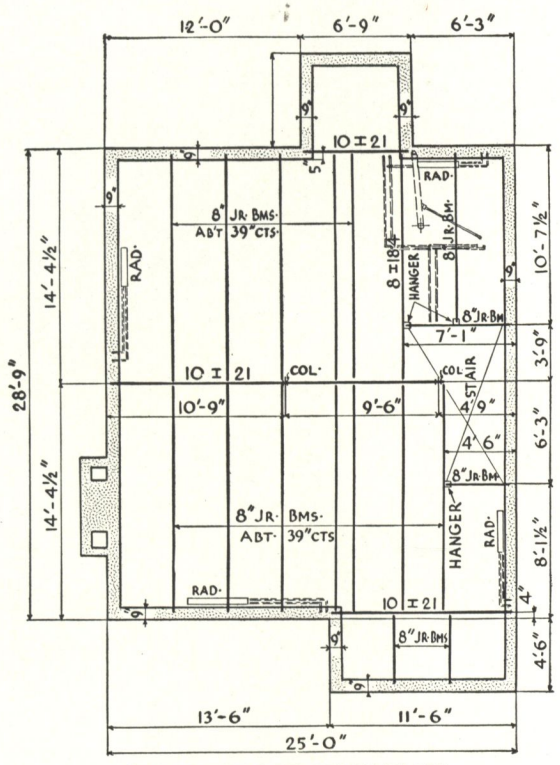
tional load of bathroom floor and walls, an 8 in. standard I-beam is used in place of a Junior Beam at this point.

It will be seen from the location of radiators and bathroom fixtures, as shown in the steel plan, that it will be necessary for the steam fitter and plumber to burn only a few holes in the webs of Junior Beams to accommodate piping.

As in the case of the foundation walls, the second floor walls are brought to an even elevation.



SECOND FLOOR PLAN

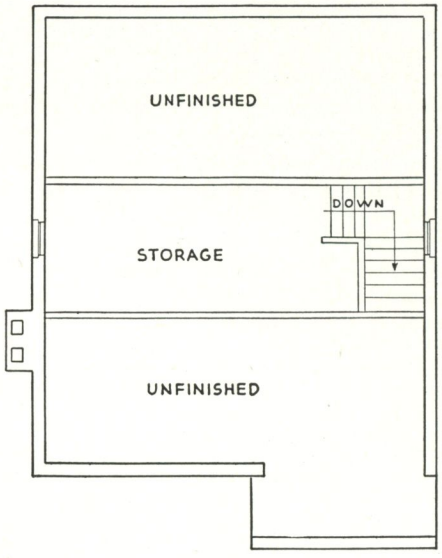


SECOND FLOOR STEEL PLAN

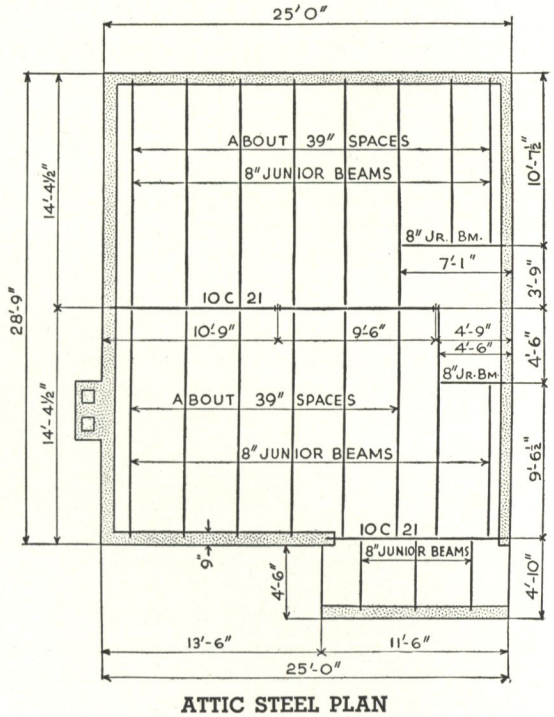
Figure 3

THE J & L JUNIOR BEAM ATTIC FLOOR

The architectural and steel plans (Fig. 4) for the attic illustrate the similarity between making up the bill of material for this floor and for the first and second floors. The principal difference between this floor and those under it is the absence of non-bearing partitions paralleling the Junior Beams in the attic, which makes it unnecessary to double the beams at any point.



ATTIC FLOOR PLAN



ATTIC STEEL PLAN

Figure 4

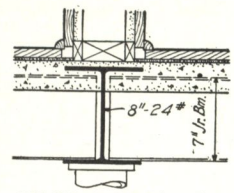
INSTALLATION DETAILS • J & L JUNIOR BEAM

Wood Finish Flooring on Sleepers

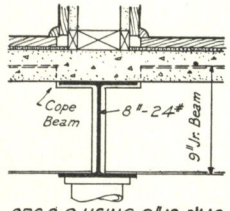
(For points at which sections are taken refer to First Floor Steel Plan, Page 10)

The large Section C-C shows 8-in. deep Junior Beams framing into a 10-in. flat flange girder. The Junior Beams rest directly on the flat lower flange of the girder without fabrication. Either 8-in. or 9-in. (see smaller Section C-C) frame into a 10-in. girder without coping. Wooden sleepers are fastened securely to the top flanges of the Junior Beams by two standard sleeper clips and steel reinforcing bars are attached with standard reinforcing rod clips. Where doorways are cut through the bearing partition, sole plates are omitted and the flooring runs over the girder without a break. Section D-D shows the construction of a typical bay and Section E-E shows the spacing of the Junior Beams at a non-bearing partition.

The vertical supports may be either regular (unfilled) pipe columns or 4-in. H-sections with plates bolted or welded on both top and bottom. Plates should be no wider than the girder flanges.

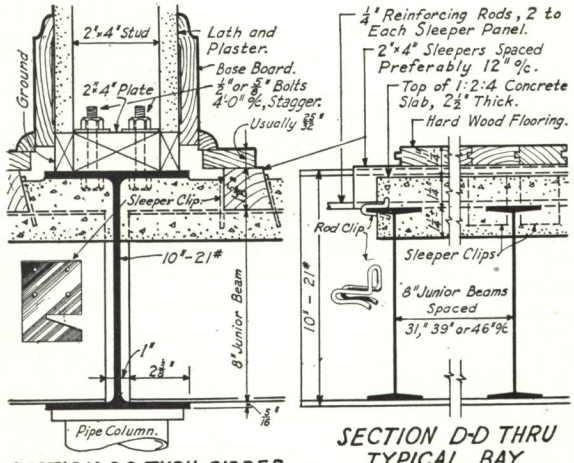


SEC. C-C USING 7" JR. B'MS



SEC. C-C USING 9" JR. B'MS

Scale $\frac{3}{4}$" = 1'-0"



SECTION C-C THRU GIRDER AT BEARING PARTITION

SECTION D-D THRU TYPICAL BAY

Scale : 1½" = 1'-0"

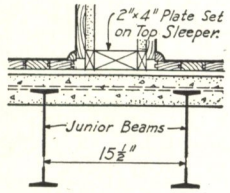
Wood or Other Types of Finish Flooring Set in Mastic

(For points at which sections are taken refer to First Floor Steel Plan, Page 10)

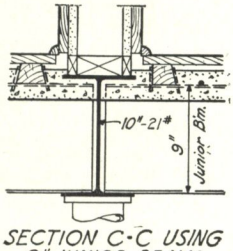
When the finished floor is to be linoleum, tile, terrazzo, wood parquetry blocks, or any material to be set in mastic, no sleepers are necessary. The concrete slab is floated smooth at the final pouring and requires no separate finish to receive the mastic. The finished flooring is then applied according to the manufacturer's directions. The 8-in. 24# flat flange section is used as a girder. The slab passes over the top of the main carrying member as shown in Section C-C.

When 8-in. or 9-in. Junior Beams are required to carry the load, they must be coped for framing into the 8-in. girder (see lower small Section C-C). The 7-in. Junior Beams can be framed without coping (see upper small Section C-C). Since the top flanges of the Junior Beams are held rigidly by the slab, no bridging is necessary to insure lateral rigidity. Section D-D shows construction of typical bay.

The vertical supports may be either regular pipe columns or 4-in. H-sections with plates welded or bolted on both top and bottom. Plates should be no wider than the girder flange.

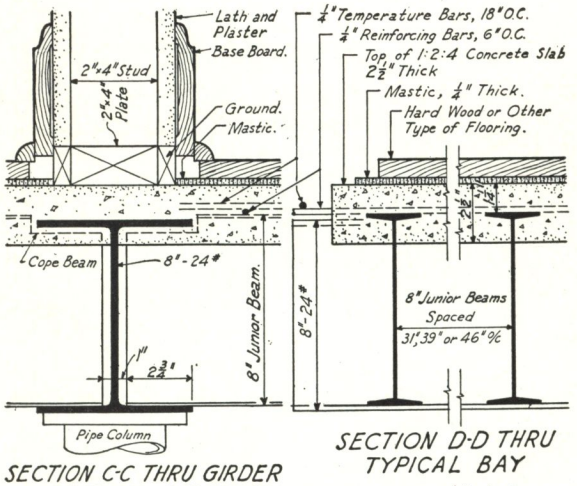


SECTION E-E THRU NON-BEARING PARTITION



SECTION C-C USING 9" JUNIOR BEAMS

Scale : $\frac{3}{4}$" = 1'-0"

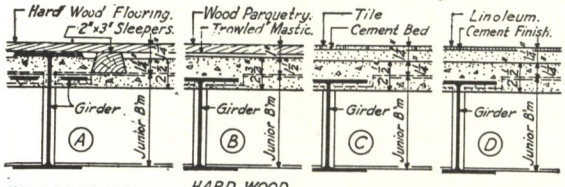


SECTION C-C THRU GIRDER AT BEARING PARTITION

SECTION D-D THRU TYPICAL BAY

Scale : 1½" = 1'-0"

Various Floor and Ceiling Treatments



HARD WOOD FLOORING ON WOOD SLEEPERS

HARD WOOD PARQUETRY LAID IN MASTIC

TILE FLOORING

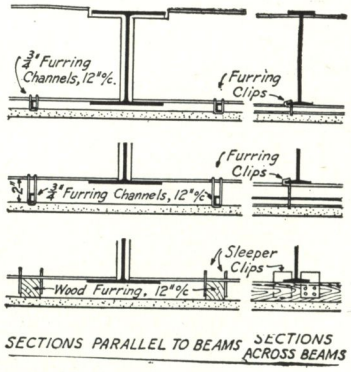
LINOLEUM FLOORING

At "A" above is shown hardwood flooring applied to sleepers. With a 10 in. girder, it is necessary to use 8 in. or larger Junior Beams. This is so that 2 in. by 3 in. sleepers will carry the finish flooring over the top flange of the girder. With an 8 in. girder any size Junior Beams may be used that satisfy the requirements of the load to be carried.

At "B" is shown hardwood parquetry block flooring set in mastic, and made to line with the construction at "A" by making the slab ¼ in. thicker. Parquetry block floors not required to line with wood flooring on sleepers would have the usual 2½ in. slab.

Details "C" and "D" show how tile or linoleum floors are made to line with the wood floor, in cases where they are used for baths, kitchens, etc.

For ordinary basement ceilings, J & L Junior Beam construction presents a neat and acceptable appearance. Where special rooms require a plastered ceiling, the construction is rendered very simple by the use of standard J & L furring clips, (see illustration). These are made in four sizes to permit a clearance of ¾ in., 1 in., 1½ in., or 2 in. between the bottoms of the beams and the plaster. The installation of electric conduit may be handled in several different ways. It may be imbedded in the concrete slab. Flexible conduit may be run through holes punched at the neutral axis in the webs of the Junior Beams. Flexible conduit may be run between the plaster and the bottoms of the Junior Beams by the use of the standard furring clips. Rigid conduit may be fastened to the bottom flanges of the Junior Beams, in which case, if a plaster ceiling is to be applied, the 2 in. furring clips are used to give ample room. For ceiling finishes that must be held in place by nails, furring strips are fastened to the bottom flanges by inverting the standard sleeper clips.



SECTIONS PARALLEL TO BEAMS SECTIONS ACROSS BEAMS

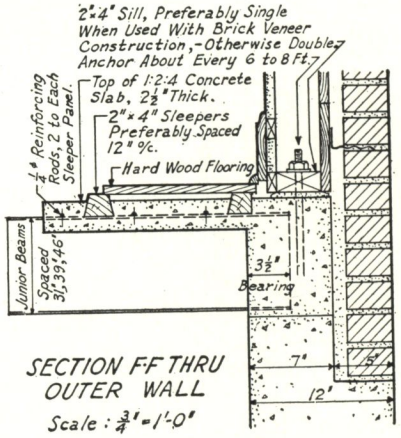
INSTALLATION DETAILS • J & L JUNIOR BEAM

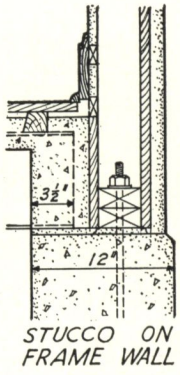
Details of End Bearing on Foundation

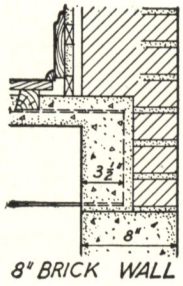
(For points at which sections are taken refer to First Floor Steel Plan, Page 10)

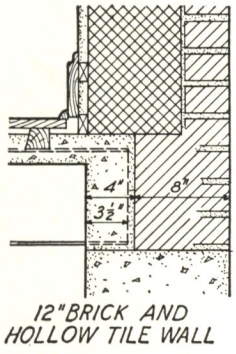
Since the top of the foundation wall on which the Junior Beams have their bearing may be irregular or uneven, it becomes necessary to level them by shimming. Cement grout or wooden wedges may be used as leveling material, since the beams are held by their upper flanges as soon as the concrete has attained its set, and the material used for shimming carries no load.

The sill details shown indicate the complete firestopping obtained with this construction. It is at the sill that a great deal of the harmful shrinkage occurs in the ordinary wood-framed house. The J & L Junior Beam floor does not shrink. It is rigid, vibration-free, and shrinkproof.









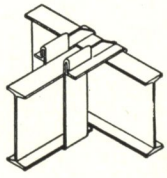
In the section showing brick veneer construction, the floor must be in place before the wall framing is erected.

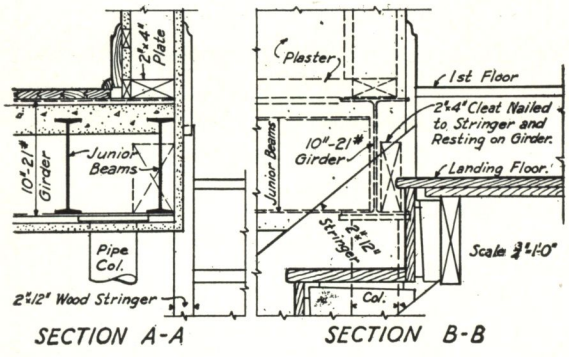
The drawings show hardwood flooring on sleepers, but the sill construction is similar for any type of finished flooring.

Stair Details and Plumbing Pipes

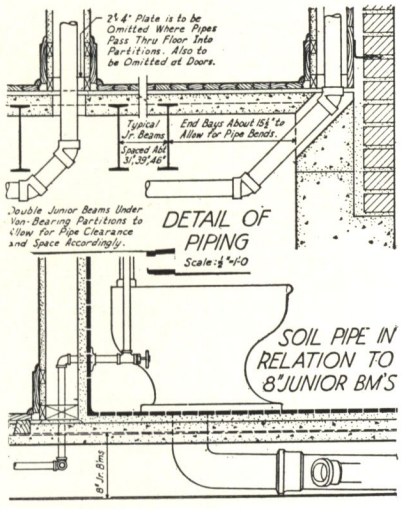
(For points at which sections are taken refer to First Floor Steel Plan, Page 10)

For supporting a Junior Beam at right angles to another Junior Beam or standard I-beam, a standard stirrup hanger is employed. This is not a fixed connection. The stirrup hanger keeps the top flanges of the beams flush. It is used for framing headers and trimming around stair openings, chimney openings, etc.





At the right is shown how pipes are carried through the concrete floor slab and into non-bearing partitions. Pipe sleeves or boxes are set in the concrete form to maintain a seal between basement and the floors above. In houses having a hot air system, the ducts enter non-bearing partitions in a similar manner. Where pipe is carried into the outside wall, the opening thru the firestop is provided by setting a pipe sleeve inside the concrete form. The first Junior Beam must be placed at least 10 in. from the wall to give the plumber room in which to work.



SPECIFICATIONS FOR J & L JUNIOR BEAM FLOOR FOR RESIDENCES

1. Jones & Laughlin Junior Beams of the size and at the spacings as shown on the plans shall be used to support the (first) (first and second) (first, second and third) floors.

2. Two Junior Beams, spaced to provide for piping, shall be used under non-bearing partitions running parallel with Junior Beams.

3. The main carrying beam (or beams) and columns under bearing partitions shall be as shown.

If bearing partition plate is to be bolted to main carrying member:

4. Main carrying beam (or beams) shall be punched in top flange with 13/16 in. holes about 4 ft. 0 in. centers staggered.

If flexible conduit is to be used:

5. Junior Beams and main carrying beam (or beams) shall be punched in webs with 13/16 in. holes about 4 ft. 0 in. centers.

6. Beams framing stairwell shall be punched in webs with 13/16 in. holes to provide for blocking.

7. Bearing of steel on walls shall be 6 in. for main carrying beam (or beams) and a minimum of 3½ in. for Junior Beams.

8. All steel shall have one shop coat of paint.

9. Concrete forms shall be built so that the bottom of the concrete slab will be approximately 1¼ in. below the tops of Junior Beams. (See "J & L Junior Beams for Residences" published 1935 by Jones & Laughlin Steel Corporation, for recommended form construction.)

SPECIFICATIONS FOR J & L JUNIOR BEAM FLOOR FOR RESIDENCES (Continued)

If wood flooring is to be nailed or pegged to sleepers:

10. Beveled 2 in. by 3 in. sleepers (2 in. by 4 in. sleepers laid flat) spaced at (12 in.) (16 in.) centers, shall be placed directly on top of flanges of Junior Beams and fastened securely to each beam by two standard plate clips, one on each side of sleeper. Concrete reinforcing shall be ¼ in. round steel reinforcing bars spaced at 6 in. centers and fastened to top flanges of Junior Beams by reinforcing bar clips. Floor shall be leveled after forms, sleepers and reinforcing bars are in place.

If finished flooring is to be set in mastic:

11. Concrete slab shall be floated smooth at time of pouring. Concrete reinforcing shall be ¼ in. round steel bars spaced at 6 in. centers and fastened to top flanges of Junior Beams by reinforcing bar clips. Temperature reinforcing shall be ¼ in. steel reinforcing bars spaced at 18 in. centers and placed at right angles to main reinforcing. Steel mesh of equivalent strength may be used in place of ¼ in. steel reinforcing bars. Floor shall be leveled after forms and reinforcing are in place.

If construction is to be frame or veneered walls:

12. Firestop around outside walls shall be constructed as shown on the plans and shall be continuous around entire building. (See "J & L Junior Beam Floors for Residences" for firestop details.)

13. Sleeves or boxes shall be placed in concrete formwork to accommodate piping which will pass through concrete floors and concrete firestop.

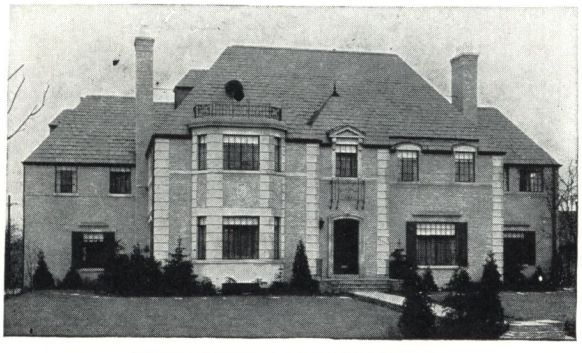
14. The concrete slab shall be a 1-2-4 mix with pea gravel or crushed aggregate not exceeding ½ in. in size. Concrete shall be of a consistency that, when poured, it may be worked well under top flanges of Junior Beams (and under sleepers. Concrete shall be leveled approximately ¼ in. below tops of sleepers.) When forms are stripped, under side of slab shall present an even surface free from honeycombing or spalling under beam flanges.

If new lumber is used for forms:

15. Form lumber, after being stripped, may be used for roof sheathing.

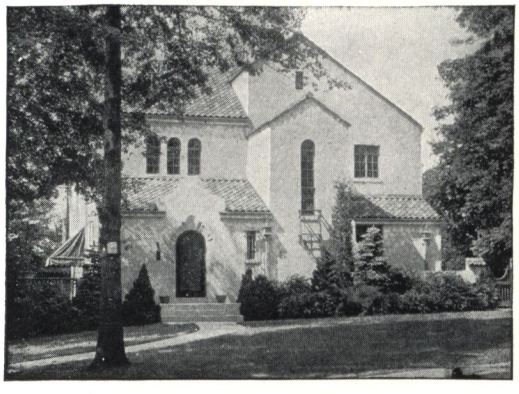
TYPICAL RESIDENCES HAVING J & L JUNIOR BEAM FLOORS

RESIDENCES, CYNWYD, PA.
Architect: Max A. Bernhardt Builder: L. H. Greenhouse & Co.



RESIDENCE, EVANSTON, ILL.
Architect: Raymond F. Houlihan Builder: C. A. Hemphill

RESIDENCE, SOUTH ORANGE, N. J.
Owner: A. Burton Cohen
Architect: Thomas Paterson, Jr.



RESIDENCE, LEXINGTON, MASS.
Architect: Howland S. Chandler Builder: Custance Brothers

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS

GENERAL OFFICES

Jones & Laughlin Building, Pittsburgh, Pa.

SALES OFFICES

Atlanta.....Healey Building
Boston.....250 Stuart Street
Buffalo.....Liberty Bank Building
Chicago.....111 W. Washington Street
Cincinnati.....Carew Tower
Cleveland.....Union Trust Building
Dallas.....Magnolia Buildi
Denver....832 Continental Oil Buildi
Detroit.....Fisher Buildi
Erie.....Erie Trust Buildi
Los Angeles.....Roosevelt Building
Memphis.....1 Auction Avenue
Milwaukee.....Bankers Building
Minneapolis.....1010 Phoenix Building
New Orleans..N. Miro & Japonica Streets
New York.....500 Fifth Avenue

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Chicago
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New Orleans
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Cincinnati.....Carew Tower	New Orleans..N. Miro & Japonica Streets
Cleveland.....Union Trust Building	New York.....500 Fifth Avenue
Dallas.....Magnolia Building	Philadelphia..Broad St. Station Building
Denver....832 Continental Oil Building	Pittsburgh...Jones & Laughlin Building
Detroit.....Fisher Building	St. Louis.....Boatmen's Bank Building
Erie.....Erie Trust Building	San Francisco....Standard Oil Building

CANADIAN REPRESENTATIVES

JONES & LAUGHLIN STEEL PRODUCTS COMPANY
Pittsburgh, Pa., U. S. A.

Toronto Daily Star Building, Toronto, Ont., Canada

J & L WAREHOUSES

Chicago — Cincinnati — Detroit — Memphis
New Orleans — New York (Long Island City)* — Pittsburgh

FABRICATING WORKS

New Orleans — New York (Long Island City)* — Pittsburgh

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of Jones & Laughlin Steel Service, Inc.